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ABSTRACT

Two high school general mathematics classrooms were differentially taught a unit on percents, one with a cooperative and the other with an individualistic goal structure. A pre-post-test design with a three-way ANOVA analysis of treatment by time within subjects was used. Neither group was found to be significantly different from the other on the pre-test. Although both groups obtained significant gains on their post-test scores as contrasted with their pre-test scores, the cooperatively goal structured classroom demonstrated significantly higher achievement post-test scores than the individualistic group. The data strongly support theories concerning the effectiveness and motivation associated with inter-group competition of small cooperating groups. (Author)

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COOPERATIVE VERSUS INDIVIDUALISTIC GOAL STRUCTURES IN HIGH SCHOOL MATHEMATICS ACHIEVEMENT

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COOPERATIVE VERSUS INDIVIDUALISTIC GOAL STRUCTURES IN HIGH SCHOOL MATHEMATICS ACHIEVEMENT.[1]

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ABSTRACT. Two high school general mathematics classrooms were differentially taught a unit on percents, one with a cooperative and the other an individualistic goal structure. A pre- post-test design with a three-way ANOVA analysis of treatment by time within subjects was used. Neither group was found to be significantly different from each other on the pre-test. Although both groups obtained significant ($p<.05$) gains on their post-test scores as contrasted with their pre-test scores, the cooperatively goal structured classroom demonstrated significantly ($p<.05$) higher achievement post-test scores than the individualistic group. The data strongly support theories concerning the effectiveness and motivation associated with inter-group competition of small cooperating groups.

INTRODUCTION. The objective of the present study was to experimentally replicate past findings regarding the effectiveness with regard to achievement gains of a cooperative as contrasted with an individualistic goal structured unit of instruction. Johnson (1979) has described three classroom pedagogical strategies noted as 1) Competitive, 2) Individualistic and 3) Cooperative. Cooperative group strategies have been defined by Slavin (1982) as "...instructional methods in which students of all levels of performance work together in small groups toward a common goal". He states further that every group member is rewarded on the "...basis of the quality or quantity of the group product according to a fixed set of standards" (p. 150). An individualistic structure is one in which students are given individual goals and by using a criterion-referenced evaluation students are assigned individual rewards. Where as student interdependence is required in the cooperative structure, students behave quite independent of each other in an individualistic structure. "The essence of a competitive goal structure is to give students individual goals and reward them by means of a "normative evaluation" system (Johnson, 1979).

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Slavin (1980; 1983) delineates why certain cooperative learning strategies increase student achievement as contrasted with other cooperative strategies. He distinguishes six major types of cooperative strategies on the interactive basis of two possible "task structures" and three possible "incentive structures." Out of 46 experimental studies contrasting his six types of cooperative structures with either individualistic or competitive goal structures, he found that small group cooperative structures having the elements of group study with group reward for individual learning were the most consistently effective in improving achievement. Two pedagogical strategies which fit this model are Student Teams and Achievement Divisions (STAD) and Teams Games and Tournaments (TGT). Out of eighteen studies examining the effectiveness of small group cooperative structures as compared to individualistic and competitive structures in mathematics instruction, 12 employed STAD and TGT. Eleven of these 12 studies significantly favored the STAD/TGT treatments. Five other cooperative strategies obtained no significant difference and only one study favored an individualistic strategy. None of the 18 studies used a midwestern, predominantly caucasian, middle-class, rural secondary school sample of low achieving students. The present study is an experimental replication of past findings regarding the effectiveness of cooperative as contrasted with individualistic goal structures in two secondary general mathematics classrooms. Based on Slavin's (1983) discussion of six different types of cooperative structures, it was hypothesized that a cooperatively structured group using inter-group competition would achieve greater than an individually structured group.

METHOD

SAMPLE AND TREATMENT. Two general mathematics classrooms taught by two different teachers were utilized. The high school was rural, midwestern, predominantly caucasian and middle-class. The freshmen and sophomore students taking this class were primarily low academic achievers. There was an equal distribution of both sexes in both classrooms and the median age was 15 years. Each classroom was differentially taught a 25 day unit of instruction concerned with the computation and interpretation of percentages. The classroom taught by the cooperative structure (n=20) followed the specifications described in Slavin's (1980) Using Student Team Learning handbook for implementing STAD and TGT. The classroom instructed with the individualistic goal structure (n=18) made use of individual drill and homework exercises as well as teacher lectures and textbook assignments. Both classes used criterion-referenced grading systems.

DESIGN AND ANALYSIS. A control group, pre-test, post-test quasi-experimental design was used to contrast the two intact classrooms' achievement scores (Cambell and Stanley, 1966). The same teacher-made pre- and post-test was given to both classes either prior to the 25 days of instruction or at the end of the instructional unit. A three-way within subjects ANOVA (Time x Treatment within subjects) with repeated measures on the time factor was used to analyze the data. Duncan multiple range tests were used in post hoc contrasts of the groups' pre- and post-test mean achievement scores.

RESULTS

Evidence to support the reliability of the achievement test was obtained for the post-test results of both classrooms combined. The KR20 of .86 was considered highly acceptable. A statistically significant ($p < .001$) interaction between treatment and time was obtained ($F(1,36)=18.62$). As can be seen in Tables 1 and 2 and Figure 1, whereas neither group was significantly different from each other on the pre-test, the cooperative group obtained significantly ($p<.05$) higher achievement on the post-test than the individualistic group. It should be noted that both groups demonstrated significant ($p<.05$) gains from pre- to post-test.

Table 1
Mean pre- and post-test achievement scores for cooperative and individualistic classrooms.

Classroom type	pre-test mean	pre-test sd	post-test mean	post-test sd
Cooperative (n=18)	3.10	2.75	19.85	5.77
Individualistic (n=20)	3.33	3.68	12.89	5.96

Table 2
Three-way within subjects ANOVA of classroom type (cooperative vs individualistic treatment) by time (pre- vs post-test).

Source	df	MSe	F	p<
Treatment	1	241.40	6.79	.01
Subj. within treatment	36	31.56		
Time (pre- vs post-test)	1	3283.43	249.32	.0001
Treatment by Time	1	245.18	18.62	.0001
Sub. by Time within Treatment	36	13.17		

DISCUSSION

As predicted, the primary research hypothesis was confirmed. The data strongly support Slavin's (1980; 1983; 1984) position regarding the effectiveness of the incentive and task structure associated with STAD/TGT, both requiring group study and group reward for individual learning. Deutsch's (1949) theories regarding cooperation and competition are the basis for Slavin's (1982) STAD/TGT models. Both models require cooperation within competing groups (inter-group competition). This element of inter-group competition provides the peer pressure as well as incentive structure which has been hypothesized as the primary motivating force behind the effectiveness of the STAD/TGT model. The results agree with 11 out of 12 previous studies dealing with similar mathematics instruction comparisons which Slavin (1983; 1984) has reported.

In conclusion, two high school general mathematics classrooms were differentially taught a unit on percents with two pedagogical strategies: 1) a cooperative and 2) an individualistic goal structure. While neither group significantly differed from each other on a pre-test, the cooperative group demonstrated significantly higher achievement on the post-test than the individualistic group. Both groups obtained significantly higher post-test achievement scores as contrasted with their pre-test scores. The data strongly support Deutsch's (1949) theories concerning the effectiveness and motivating qualities associated with inter-group competition among small cooperating classroom groups. The ease with which STAD/TGT techniques can be developed by classroom teachers (Slavin, 1982), as well as their effectiveness (Johnson, et al, 1976) would lead one to conclude that teachers of general mathematics and other disciplines should give this approach serious and favorable consideration.

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